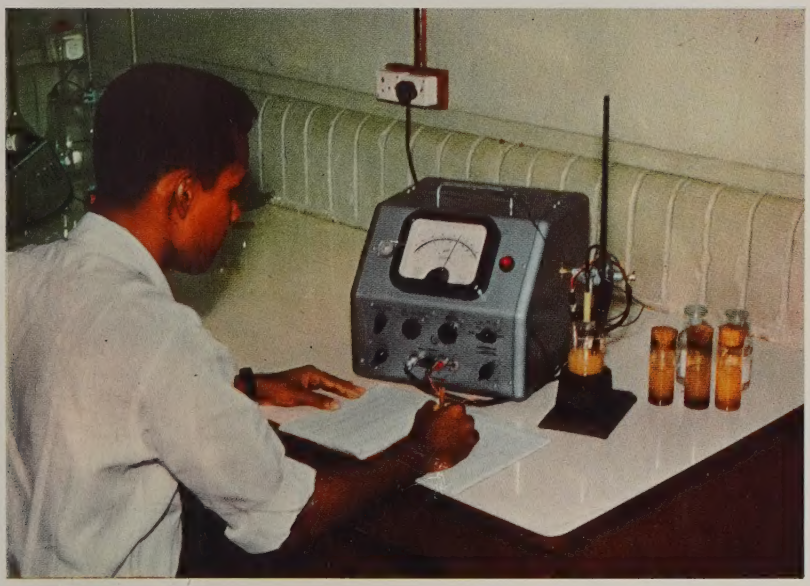
# PLANTERS' BULLETIN

## OF THE RUBBER RESEARCH INSTITUTE OF MALAYA



PLANTERS' BULLETIN FIFTY

CONTENTS


| | Page |
|---|---|
| Editorial: Replanting on Small Estates | 91 |
| Seed Treatment and Sowing Methods for Cover Crops | 94 |
| Soil Reaction and Rubber Cultivation | 98 |
| An Experiment with Magnesium Limestone | 103 |
| Notes, Book Review, R.R.I. News | 105 — 110 |


Price
50 Cents

September
1960

# RRI

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# PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA

Kuala Lumpur September 1960 Number 50

## Editorial: Replanting on Small Estates

A table in our editorial in *Planters' Bulletin 47,* March 1960, drew attention to the fact that the smaller rubber estates, by neglecting to increase their acreage of high yielding material, had failed to maintain a competitive position in relation to the rest of the industry. The table is repeated here for rapid reference.

| *Size group (acres)* | *Total acreage planted* | *Group acreage as % of total estate acreage in Malaya* | *Percentage of group acreage occupied by:* | | |
|---|---|---|---|---|---|
| | | | *Mature unselected seedlings* | *Mature high yielding material* | *Immature high yielding material* |
| Under 500 | 303,000 | 15 | 69 | 17 | 14 |
| 500–1000 | 217,000 | 11 | 52 | 27 | 21 |
| 1000–2000 | 431,000 | 21 | 43 | 31 | 25 |
| 2000–3000 | 271,000 | 14 | 40 | 35 | 25 |
| 3000–5000 | 377,000 | 19 | 40 | 35 | 25 |
| Over 5000 | 389,000 | 20 | 33 | 44 | 22 |

### THE REPLANTING CYCLE

The failure of these estates to take full advantage of aid provided for replanting is a matter for serious concern. On estates of between 100 and 500 acres (which account for 303,000 acres or 15% of the total estate acreage in Malaya) only 14% or about one-seventh of the planted acreage is now immature rubber. If six years is allowed for the period of immaturity and a constant level of one-seventh immature rubber is maintained, a complete replanting cycle will have a duration of about 42 years. Since only 17% of the total planted acreage on these estates is mature high yielding rubber, 69% remains to be replanted with improved material. It will therefore be roughly 30 years before all old unselected seedling rubber is replaced by high yielding material. The position in the 500-1000 acres category is considerably better,

but even so, at the rates of progress indicated by the figures, it will be about 15 years before they are fully planted with high yielding material. The same calculations applied to the categories of estates of more than 1000 acres indicate that these estates will be planted entirely with high yielding material in about 10 years' time.

It is, of course, a matter of pure surmise whether or not wage rates and rubber prices in the years ahead will permit economic production from unselected rubber, but at least it is certain that if there is profit in unselected rubber there is bound to be a greater return from high yielding material. It is self-evident that rubber areas should have maximum output at the lowest possible cost and assistance to this end should not be neglected.

## R.R.I.M. SURVEY OF THE SMALLER ESTATES

Our Estates Advisory Service has recently collected information in a sample survey which throws light on the great variation in the acreage planted with high yielding rubber on individual estates within the size group 100 — 1000 acres. The results of the survey are illustrated in *Figures 1* and *2*. Fifty per cent of the estates* have no immature rubber and a further 20% of the estates fall into two groups: those having 10% or less and those having 20% or less immature rubber. Thus only the remaining 30% of all the estates surveyed have replanted to the extent of having more than 20% of their individual areas under immature rubber.

The 20% level of immature rubber is of special significance because since November 1955 there has been a Government scheme for estates whereby a grant of $400 per acre is provided towards the cost of

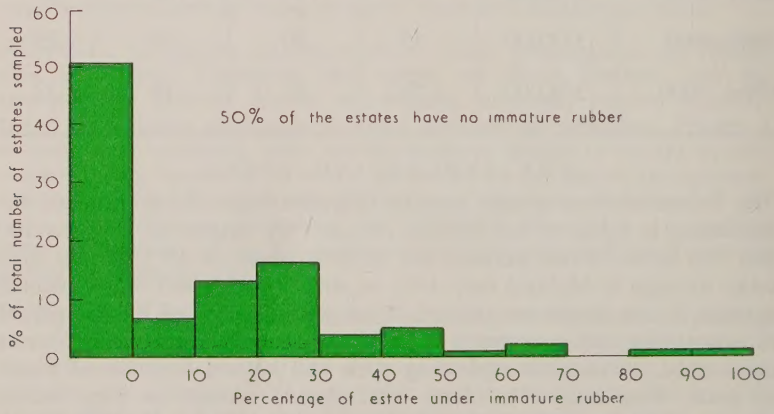



*Figure 1. Estates of 100-1000 acres grouped according to the percentage of each estate under immature rubber.*

* Constituting 43% of the planted area in the 100-1000 acre category.

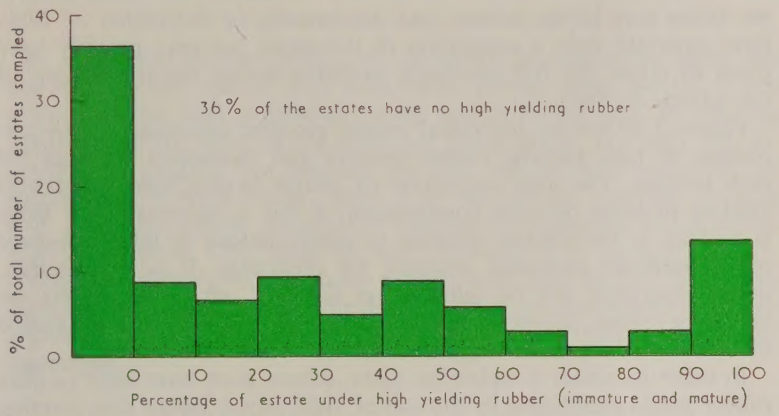

% of total number of estates sampled
40
30
20
10
0
36% of the estates have no high yielding rubber
0 10 20 30 40 50 60 70 80 90 100
Percentage of estate under high yielding rubber (immature and mature)

*Figure 2. Estates of 100-1000 acres grouped according to the percentage of each estate under high yielding rubber (mature and immature).*

replanting *on up to 21% of the planted acreage of an estate at 31 December 1954*. The scheme permitted payment of the subsidy for replanting effected in 1953 and 1954.

It may be objected that plantings of the years 1953-4 are already mature and that our record of immature areas does not fully represent the areas replanted under the Government scheme. However, the total replanting in the 100 to 1000 acre category for 1954 amounted to only 2000 acres, or less than 0.5% of the planted acreage, and it can be assumed that planting in 1953 was even less. We feel therefore that our figures for the acreage of immature rubber on estates are likely to correspond fairly closely with the actual acreage replanted under the Government replanting scheme.

It appears likely that this failure to initiate replanting may be attributed to lack of knowledge on the part of owners. Our survey has also shown the importance of providing published advice in languages other than English for estate owners in the 100 — 1000 acres group and to meet this need the Institute plans to produce a *Planters' Bulletin* in Chinese as well as in the national language. These publications will take time to produce, and furthermore, in the first instance, are likely to be studied only by those who are already well informed on rubber planting topics. The matter of replanting on these estates is of some urgency, because to qualify for grants under the current scheme, establishment of high yielding material must be completed by 1962 and certain preparations must be made well in advance of planting if the best results are to be achieved.

## A QUESTION OF TIME

It thus appears that only about 30% of estates of less than 1000 acres have taken full advantage of the Government scheme; about 50% have

not taken part in the scheme and the balance, in the region of 20%, have replanted only a proportion of the quota but may possibly have plans to utilise the full assistance available before the termination of the scheme in 1962.

*Figure 2* shows the individual estates grouped according to the percentage of high yielding rubber (mature and immature) recorded for each holding. The high proportion of estates having little or no high yielding material provides confirmation, if this is necessary, that there is nothing in the existing position to justify failure to take advantage of the valuable assistance available for replanting. It is evident that, unless replanting can be initiated on the 50% of estates having no immature rubber, complete replanting will *not* be achieved in the period of fifteen to thirty years suggested above.

In order to obtain a replanting grant, estates must have high yielding rubber plants established by the end of 1962, which means that planting must take place in 1961 if budgrafting in the field is intended. Furthermore, the planting of 21% of the total acreage in one year may be too big a project for inexperienced planters and the spreading of work over two or more years is preferable. Many of the smaller estates will therefore need to turn their attention to replanting immediately. There is no reason to believe that those who fail to make use of the scheme within the prescribed time will ever again have the opportunity to obtain assistance for replanting on the present scale.

# Seed Treatment and Sowing Methods for Cover Crops

SINCE THE ARTICLE 'Pretreatment of Leguminous Cover Crop Seeds' in *Planters' Bulletin 39* was written, various points have arisen in correspondence and notes (see, for instance, *Planters Bulletin 42*, p. 72; *44*, p. 122 and *49*, p. 88). We summarise here the main points of the original article, with additions in the light of more recent knowledge.

It occasionally happens that the germination of fresh seed is so good that little practical advantage can be obtained by pretreating the seed. If the seed is fresh it is worthwhile testing a sample, because if the overall germination is good (20% in 10 days or 25% in three weeks), it is probably best to sow a mixture of creeping legumes at 5 lb per acre without pretreatment. For the test, a minimum of one thousand seeds selected from different parts of the lot should be sown thinly on damp blotting paper in a covered earthernware dish and kept moist; the proportion of germination is measured by counting.

Cover crop seeds must be kept dry. Storage of seed under damp conditions reduces the viability and very markedly decreases the proportion which will germinate easily in all the commonly used legumes.

## SEED TREATMENT AND GERMINATION

The proportion of seed which will germinate in adequately moist soil conditions within one to three weeks after sowing varies greatly. If one quarter of the seed germinates easily and 5 lb per acre of creeping legume seed are sown in six drills per chain across the field, the expectancy is roughly one seedling per inch within three weeks. If the germination is much better, there is a risk of the seedlings choking each other, but poorer germination leading to inadequate establishment is more common. One object of seed treatment is to improve the percentage germination so that lower seeding rates may be used with more certainty of adequate establishment. Effective pretreatments accelerate germination so that the cover plants grow away before weeds can regenerate.

## SUSCEPTIBILITY TO DROUGHT

The main disadvantage of the cover-crop seed treatments used hitherto is that the seeds are soaked or washed in water. The absorbed moisture enables germination to start even if the soil is too dry to maintain development, with the result that the young seedlings may succumb to drought. This situation can usually be avoided by waiting for rain before treating and sowing such seed.

When seed is treated with concentrated sulphuric acid and washed in water, it is possible to dry the seed rapidly and effectively by spreading it out thinly under a hot sun; seed treated in this way will not be susceptible to drought. Slow or imperfect drying after acid treatment can be most unsatisfactory.

The alternatives are to treat the seed dry or with a liquid other than water.

## MECHANICAL SCARIFICATION

A very successful dry treatment is to scratch or 'scarify' the seed coats in order to assist moisture absorption from the soil. For preliminary studies we have used an hexagonal wooden drum (see illustration) lined with sandpaper, one side being removable for access. The drum is powered by a $\frac{1}{2}$ h.p. electric motor and rotates at 75 r.p.m. about its long axis.

Seven pounds of seed rotated for twenty-four hours can be very effectively treated at a cost in electric power of up to 20 cents per lb. The seeding rate for such scarified seed is as low as 3 lb per acre.

Estate engineers may be able to improvise other simple scarifiers and we suggest that the method is well worth trying. Mechanical scarification is not effective on sticky seed such as *Clitoria rubiginosa* or on seeds in indehiscent pods such as those of *Stylosanthes*, which must either be treated with acid or heated.

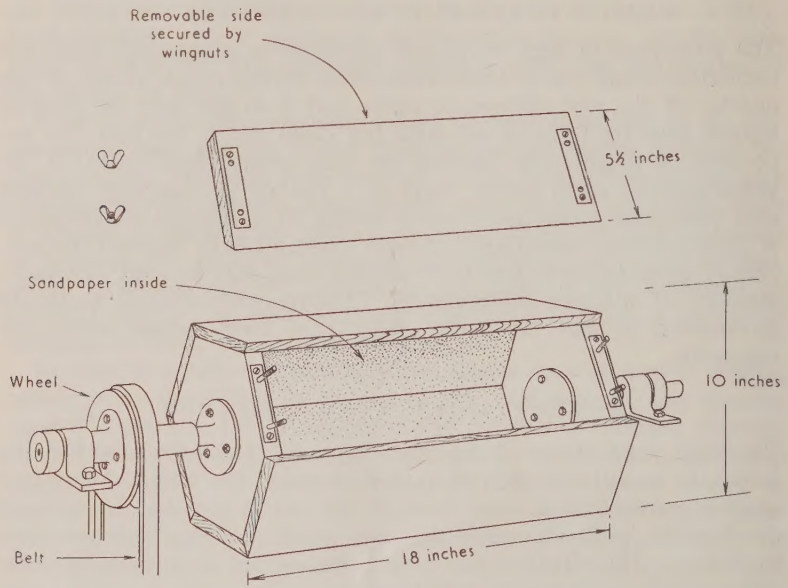



*Diagram to illustrate the construction of the machine for scarification of seed on an experimental scale.*

### ACID TREATMENT

The seeds are placed in a large glass, earthernware or aluminium vessel. Add commercial concentrated sulphuric acid at the rate of not less than one twenty-fifth by weight of the seed. If more acid is used, mixing is somewhat easier but the subsequent washing of the seed needs more care. Up to equal weights of acid and seed have been used, but we prefer to apply a smaller quantity, such as an ounce of acid to a pound of seed. The seed can be stirred with a glass rod, or with a strip of aluminium or wood.

Suitable periods of treatment allowing a margin of safety are:

| | | |
|---|---|---|
| *Calopogonium* and *Centrosema* | ... | 10 minutes |
| *Desmodium* and *Flemingia* | ... | 10 minutes |
| *Pueraria* | ... | 15 minutes |

Treatment with concentrated sulphuric acid should always be carried out under proper supervision because of the risks of burning. Mixing with water is especially dangerous as the acid is liable to 'spit' in the worker's face. Plenty of clean cold water should be available to wash away any acid which may be spilt on the skin and bicarbonate or other suitable substances should be kept at hand for the treatment of burns. Unused acid should be returned to safe storage and used acid washed away with plenty of water.

Once the treatment is completed, a large excess of cold water must be added quickly to make the acid ineffective. If a large earthernware vessel (such as a Shanghai jar) has been used for the treatment of a relatively small amount of seed, a convenient way of diluting the acid is to pour the water into the vessel from buckets. If an aluminium bucket has been used, the contents should be poured (or bucket and contents dropped) into a coagulation tank previously three-quarters filled with water, the mouth of the bucket being pointed away from the operator. The seed is washed by decantation or with running water for three hours and collected in a cloth or bag at the time when the water is poured or run off. Finally, the seed must be dried rapidly in the sun if it must be sown during drought. In a spell of wet weather, it can be dried adequately for handling and then sown immediately. The rate of sowing for acid-treated seed is 2 lb per acre.

### HEAT TREATMENT

The alternative to the above methods is one of the heat treatments, among which the hot water is best known and has been described in *Planters' Bulletin 39*. However, hot water gives very variable results in practice, often being least effective with the poor seed samples which are most badly in need of improvement. Consequently, hot water treatment is not recommended when there is any alternative.

A safe and effective method of heat treatment is immersion in pure glycerine at 50°C (120°F, smokehouse temperature) for six hours. During the treatment, the glycerine is kept in a bucket at this temperature and the seeds are stirred in until they are all thinly coated with glycerine; there is no need to have a free-running excess. Even so, a gallon of glycerine will treat only 20 lb of seed, and, at present costs, this is more than $1.00 (Malayan) per pound of seed treated. The bucket of glycerine-coated seed is left for six hours in a warm smokehouse. The seed is not washed but, after cooling, is mixed with ground rock phosphate which absorbs the excess glycerine and makes handling easier. If *Rhizobium* compost is being used, it can be stirred into the cooled glycerine before the phosphate is added.

Crude glycerine (purity approx. 80%) can be obtained from soap factories at about one third of the cost of pure glycerine; applied to the seed as described above, it is less effective than pure glycerine but more effective than hot water. Its use enables samples with a low proportion of easily germinable seed to be sown at the normal rates for good seed (5 lb per acre for creeping legumes).

### SOWING

The seeding rates quoted above are for mixtures of equal parts by weight of *Calopogonium mucunoides, Centrosema pubescens* and *Pueraria phaseoloides*. Seed should be sown thinly in shallow drills, but it may be broadcast if recent mechanical cultivation has provided a

suitable seed-bed. Rock phosphate has been shown to be beneficial, both when mixed with the seed and when dusted on the young plants. Where drills are used, it is simpler to give a liberal dusting of rock phosphate along the drill at sowing. Inoculation with a *Rhizobium* culture (available with instructions from our Pathological Division) will ensure the presence of effective nitrogen-fixing bacteria.

### SEED MIXTURES

In replantings, the objective is to obtain a cover of creepers to protect the exposed soil as soon as possible. However, it may be desired to diversify the covers from the outset by sowing additional species such as *Flemingia congesta* and *Desmodium ovalifolium,* or experimental covers such as *Clitoria rubiginosa;* such diversification is an advantage in the event of severe attacks of pests on one or other of the creeping species. Other benefits from the use of mixed covers derive from the differences in rooting habits and shade tolerance already discussed in *Planters' Bulletin 37* and *39*. The woody plants *Flemingia* and *Desmodium* should be sown in separate drills from the herbaceous creepers such as *Pueraria* in order to ensure uniform establishment of both types.

# Soil Reaction and Rubber Cultivation

SOIL REACTION or, as it is more often called nowadays, soil pH, enters into discussions of many aspects of the cultivation of field crops, especially the nutrition of the plants and the use of different fertiliser materials. In this article an outline is given in very general terms of what is meant by soil pH and what influence this soil property has on the nutrition and growth of *Hevea.*

In the simplest terms soil pH can be said to be a measure of the acidity or alkalinity of the soil solution. Acids are, by definition, substances which give positively charged hydrogen atoms (ions) in solution and the concentration of these hydrogen ions is measured on the pH scale. The most obvious reference point for the scale is that of pure water which is neither acid nor alkaline, but neutral. The mid-point of the pH scale, numbered 7, is a measure of the hydrogen ions present in a given volume of pure water; pH values less than 7 are acid, while those greater that 7 are alkaline or *basic.*

### pH AND THE CLAY FRACTION IN THE SOIL

The pH of a soil is associated chiefly with the clay fraction which differs in many respects, chemically and physically, from the larger sand and silt fractions. The most important difference is that the colloidal clay particles are negatively charged and, neutralising this charge, we find both positive hydrogen ions and the positively charged basic ions, calcium, magnesium and potassium (with smaller amounts of other minor

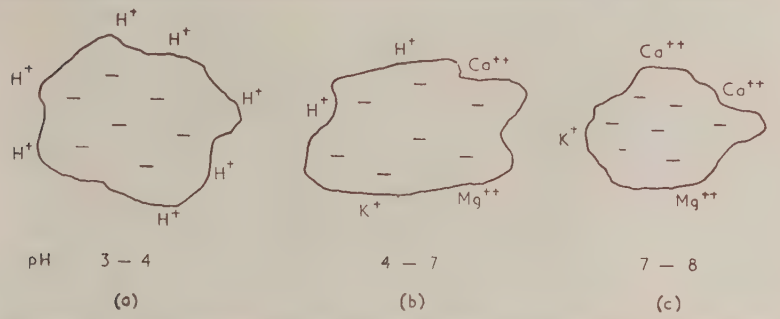



*Figure 1. The base-clay complex at different pH levels. The plus and minus signs indicate positive and negative electrical charges. Potassium, calcium, magnesium and hydrogen are represented by K, Ca, Mg and H.*

elements). These bases, attached to the surface of the clay particles by electrostatic forces, are readily exchanged with other basic ions or with hydrogen ions added to the soil solution; they are also the main source of basic nutrients essential for satisfactory plant growth. The pH, being a measure of the hydrogen ions in the soil solution associated with the clay particles, is thus an indirect measure of the proportion of the negative charge on the clay which is neutralised by hydrogen ions. *Figure 1* illustrates the extreme cases of complete saturation of the clay with (a) hydrogen and (c) basic ions together with an intermediate stage (b). Average pH values of the soils in these conditions are also given. It follows from this that both the amount of clay present and the pH affect the quantity of basic nutrients available to plants. Low values of pH are associated with low levels of basic nutrients and high pH values with high levels.

## THE OPTIMUM pH RANGE FOR HEVEA

It has been known for many years that there is a pH range for most plant species which seems the most satisfactory for optimum growth. The better known examples of these specific ranges are found in temperate agriculture, for example the satisfactory growth of potatoes on soils which would be too acid to support a crop of barley or clover. Tropical crops exhibit similar differences and, as would be expected from its natural habitat, *Hevea* is one of those crops which will grow well in highly leached acid soils, its requirement for calcium, the main exchangeable basic ion, being comparatively low. It does not seem to thrive on soils saturated with bases (mainly calcium) such as those derived from or containing limestone. The most commonly quoted pH range for satisfactory growth is from 4 to 6.5 on the pH scale. Fortunately the soils of Malaya have a pH within the optimum range, most of them falling between 4.5 and 5.5 (*Figure 2*).

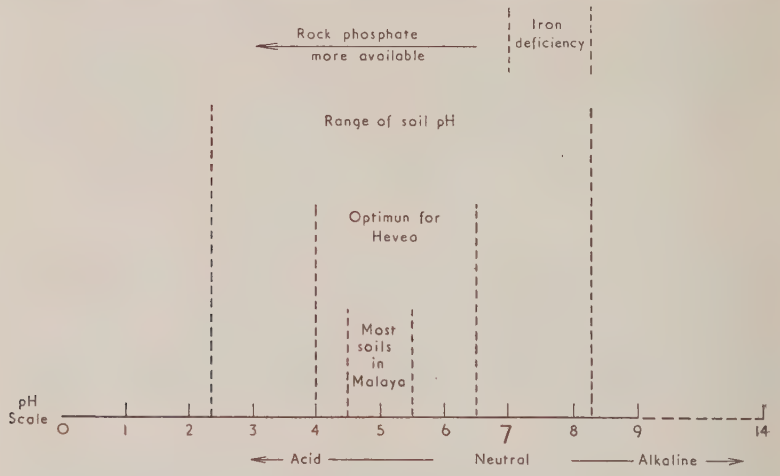



*Figure 2. Soil pH and the pH scale.*

## EFFECT OF FERTILISERS ON SOIL REACTION

How can the pH of the soil be changed and how is it influenced by the continuous growth of *Hevea?* Also, under normal estate practice, is there any prospect of the soil pH shifting to a point outside the optimum range?

The most obvious way in which pH can be influenced is by the application of acidic or basic materials—such as mineral acids, limestone and some forms of nitrogenous, phosphatic and other fertilisers. In fact, most materials can be classified according to their effect on soil reaction and in the following table the commonly used fertiliser materials are divided into five main categories according to their effect on soil pH.

| *Strongly acidic* | *Less acidic* | *Neutral* | *Less basic* | *Strongly basic* |
|---|---|---|---|---|
| Sulphate of ammonia | Urea | Rock phosphate | Sodium nitrate | Limestone |
| | Ammonium nitrate | Magnesium sulphate | | Magnesium limestone |
| | Super-phosphate | Potassium chloride | | Basic slag |

Recent determinations of soil pH in long term field experiments have given some idea of the changes which can be expected from normal additions of fertiliser mixtures to commercial rubber areas over a period of years. These have shown that the fertilisers have a practically negligible effect on soil pH, apart from sulphate of ammonia which is acidifying and lowers the pH roughly in proportion to the amount applied.

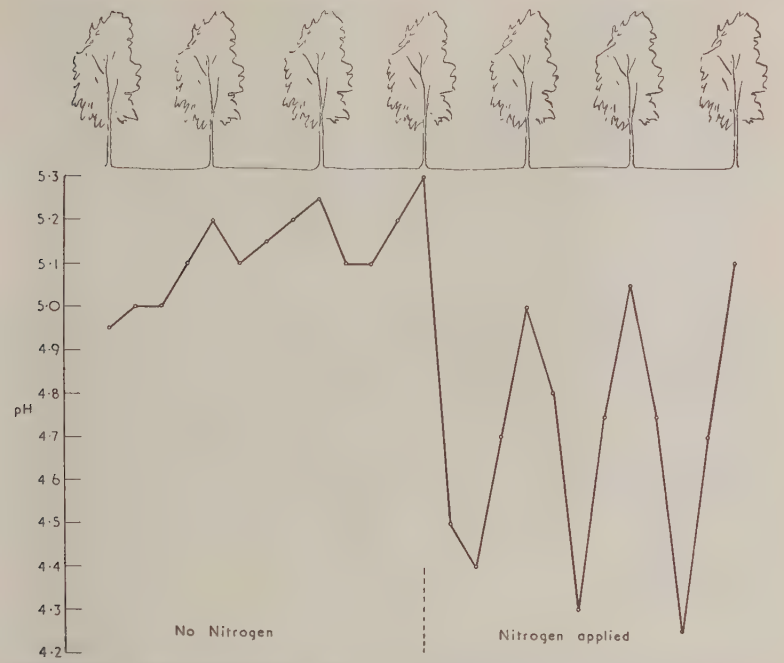



*Figure 3. pH across the tree rows. Sulphate of ammonia has been applied annually in the centre of the three inter-rows on the right.*

The most severe change measured was in an area of sandy soil (which would be expected to change in pH more rapidly than a heavy clay soil) where values had been lowered from 5.0 to 4.1 by annual applications of 3 lb per tree of sulphate of ammonia for eight years. At the other extreme, a reduction in pH due to the application of only 7 lb per tree (over a period of three years) could still be measured five years later, but the reduction only amounted to 0.1 pH units. The latter example shows that increased acidity is not easily reversed by natural processes. In the former experiment, pH determined on soil samples across the rows showed that the lowering had taken place only in the inter-row area where the fertiliser was applied (this is illustrated in *Figure 3*).

*Effect of low pH*

Associated with this lowering of pH there were reductions in both the exchangeable calcium and exchangeable magnesium of the soil and, in the latter case, the leaves showed signs of deficiency. The lowering of the calcium level does not seem to have very severe effects on the growth of *Hevea,* but the lowering of the exchangeable magnesium level could have detrimental effects on growth and yield.

It is advisable therefore, where nitrogen alone is being applied as sulphate of ammonia, to use a less acidifying form of nitrogen such as urea. Urea has the added advantage of being a more concentrated fertiliser, containing 46% nitrogen compared to only 21% in sulphate of ammonia. Transport costs are halved and, since the unit cost of the nitrogen itself is the same for both fertilisers, urea is slightly more economical to use. The only disadvantage in using urea instead of sulphate of ammonia is that it soon becomes damp when exposed to air and consequently must be applied as soon as the bags have been opened.

*Correction of Acidity*

Raising the soil pH is normally associated with the application of basic materials, e.g. limestone, and such additions are standard practice on the less acid-tolerant crops in temperate regions. In the tropics however, the effects of added limestone have not been spectacular, even on acid soils, and field experiments have shown no beneficial effects on the growth of *Hevea*. In present-day commercial rubber growing, the magnesium deficiency which occurs on many inland soils is often ameliorated by the application of magnesium limestone and the planter may wonder whether there is any danger of increasing the pH above the optimum range. This danger, however, is almost negligible at the rates of application used. The amount of limestone required to raise the pH to 6.5 (as determined in the laboratory) usually ranges from 10—30 cwt per acre, but the normal dressing of magnesium limestone at 2—4 lb per tree corresponds to only $2\frac{1}{2}$—5 cwt per acre. Measurements of soil pH eight months after the application of 10 cwt of limestone per acre to an average Malayan granite soil show that the value has been raised by only 0.5 pH units. It can also be shown that for every 1 lb of sulphate of ammonia applied to the soil, approximately $1\frac{1}{2}$ lb of limestone must be added to restore the pH to its former value.

## pH AND THE AVAILABILITY OF PHOSPHATE AND IRON

In the above paragraphs we have discussed the effects of pH on exchangeable bases and how these are affected by added fertiliser materials. It should be emphasised that pH and rubber growth are not exactly related and that it is easy to visualise a soil of high pH saturated with bases, and yet acutely deficient in particular plant foods such as potassium or magnesium. The pH does, however, have a direct influence on the availability to the plant of other essential nutrients. The relation of pH to the availability of phosphate from rock phosphate and superphosphate has been discussed in a recent article in *Planters' Bulletin 41*, March 1959, page 34. Briefly, rock phosphate is quite suitable for use on more acid soils but is less available than superphosphate at higher pH levels.

Another important element which is affected by soil reaction is iron.

At low pH levels, iron is readily available to plants but as the value rises above about 6.5 the availability rapidly decreases; in *Hevea* a chlorosis of the leaves due to iron deficiency is induced. Such effects may be seen where attempts have been made to grow rubber on old building sites where there is a large residue of alkaline concrete rubble and the pH is usually above 7. The obvious remedy is to lower the pH by means of acidic fertilisers and these can usually be applied with advantage. It is often found, however, that the percentage of limestone materials in the soil is so high that excessive quantities of acidifying materials would be required to effect any significant reduction in pH. In such cases, the availability of the iron in the soil can be slightly increased by the use of a heavy mulch, preferably of readily decomposable material. Most iron salts when added to the soil are not effective and are merely made unavailable by the high soil pH. None of these remedies is really satisfactory and under alkaline soil conditions *Hevea* should not be planted.

The uptake of several other elements such as molybdenum, manganese and boron are influenced by the soil pH but these effects have, at the moment, little practical significance.

### CONCLUSIONS

Soil pH may be taken as a measure of the base saturation of the clay fraction and is associated particularly with the levels of the exchangeable bases calcium, magnesium and potassium in the soil. The range of pH for satisfactory *Hevea* cultivation is fairly wide but in general the more acid soils are preferable, provided they contain satisfactory levels of potassium and magnesium. Soils of a higher pH limit the supply of iron and the availability of rock phosphate—the cheapest and most commonly used phosphate fertiliser. Finally, in order to avoid unnecessary losses of bases, particularly potassium and magnesium, urea is preferable to sulphate of ammonia when applied as a single nitrogen fertiliser.

## An Experiment with Magnesium Limestone

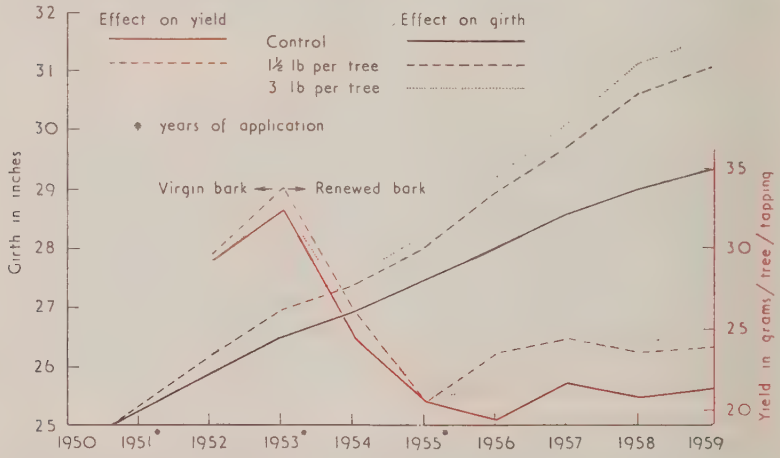
THE FULL RESULTS are now available from an experiment testing the effect of magnesium limestone on a mature rubber area showing symptoms of magnesium deficiency. They should be of interest to many estates situated on inland soils where it has been found necessary to apply magnesium limestone to similar areas.

The field concerned was budded in 1938 with Pil D 65 and tapped for the first time in July 1947. As far as is known, the trees were

fertilised regularly to 1942 and 3 lb per tree of an NPK mixture were applied again in 1947, after post-war rehabilitation. In 1950, the trees showed a marginal yellowing of the leaves typical of the magnesium deficiency symptoms which have since been described and illustrated in an article in *Planters' Bulletin 31* (July 1957).

At that time, the effects of applied magnesium fertilisers had not been tested in the field and so, at the end of 1950, the opportunity was taken to mark out an experiment with three levels of magnesium limestone (0, 1½, 3 lb per tree), three levels of potash, and three levels of a nitrogen/phosphate mixture applied to the different plots. These fertiliser dressings were repeated in 1953 and in 1955, making three applications in all. Measurements of tree growth were made annually and yield records were taken for one tapping every month throughout the years 1951-59.

The results of these measurements for the magnesium treatments are set out in the accompanying graph.




*The effect of magnesium limestone on the growth and yield of dry rubber.*

*Growth*

Magnesium limestone increased the rate of growth in the first and in each subsequent year. When the measurements were stopped in 1959 there had been an increase in growth (over the eight years of the experiment) of 39% from the 1½ lb applications and an increase of 51% for the 3 lb applications, compared with the control plots. Foliage colour improved noticeably in the magnesium treated plots soon after the fertilisers were applied and in the later years there was a marked effect on the time of wintering, the magnesium-deficient control plots wintering much earlier than the plots treated with magnesium.

*Yield*

Yield did not appear to respond to the magnesium limestone as quickly as growth and it was not until five years after the first application that yield increases were statistically proven. In subsequent years the response increased until in 1958 the magnesium treated plots (the highest level) were yielding 14% more rubber than the controls. This slow response in yield emphasises the long-term nature of the manuring of rubber trees and shows that the full effects of fertilisers may not be obtained until several years after they have been applied.

*Other Fertilisers*

The other fertiliser treatments did not give results as striking as those for magnesium. Potash had no definite effect on growth or yield but the nitrogen/phosphate mixture did give definite responses in growth at both rates of application; on yield however, the effects were smaller and were only definite in one year (1955-56).

*Recommendations*

The benefits of magnesium limestone on a deficient soil such as this have been convincingly demonstrated, and in such areas the recommendation of the Institute is to apply 2-3 lb per tree of magnesium limestone and to follow this up by the use of fertiliser mixtures containing magnesium. If the deficiency symptoms persist, particularly in the later months of the year, a further dressing of magnesium limestone should be applied.

## Journal

The *Journal of the Rubber Research Institute of Malaya*, Volume 16, Part 3, contains three papers which are summarised below:

R.S. Gale. *An Apparatus for the Study of the Drying Rates of Sheet Rubber*. Communication 330.

This paper is the second of a series of papers recording the more fundamental side of the Institute's programme of work on sheet rubber drying. (The first was Communication No. 325, mentioned in *Planters' Bulletin 46*). It describes an apparatus for the accurate experimental determination of the drying rates of sheet rubber samples. The temperature of the drying air can be varied between room temperature and 200°F and relative humidities up to 70% can be achieved, the air being heated with electric elements and humidified by live steam injection.

Automatic control maintains the desired conditions with an accuracy of $\pm$ 0.5°F and $\pm$ 2% R.H. Sample sheets (6 $\times$ 10 in.) can be weighed without removing them from the drier; a sheet selector mechanism, operated from outside the drier, enables sheets from any one of twelve positions in the drying zone to be transferred to a weighing compartment, which is isolated from the air stream but in which the temperature and humidity are similar to the drying air. Using this system and a sensitive

balance, a sample sheet 2 mm thick can be weighed to an accuracy of ± 0.01%. Thus, accurate weighing can be carried out with the minimum of disturbance to the progress of the drying.

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G. A. WATSON. *Interactions of Lime and Molybdate in the Nutrition of Centrosema Pubescens and Pueraria Phaseoloides.* Communication 331.

Molybdenum is a minor nutrient element that plays an important part in the symbiotic nitrogen fixation process occurring in legumes. This paper describes results obtained from two pot culture experiments in which the effects of applications of lime and sodium molybdate on the growth and nutrient status of *Centrosema pubescens* and *Pueraria phaseoloides* were examined. With soils of the Serdang, Rengam and Malacca series, the uptake of molybdenum at a soil pH value of below 5 was sufficiently low to limit plant growth. Application of sodium molybdate at the rate of 1 lb per acre and/or liming the soil to pH 6, increased the molybdenum and nitrogen contents of the plants, and increased dry weight production. The results are of particular value in demonstrating how the level of available molybdenum in the soil can be raised by application of either sodium molybdate or lime.

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K.R. MIDDLETON. *A Comparison of Rock Phosphate and Superphosphate as Sources of Phosphorus for Seedling Rubber.* Communication 332.

As pointed out in *Planters' Bulletin 14,* March 1959, opinion at the Institute is that Christmas Island rock phosphate is about as effective a fertiliser as superphosphate when used in Malayan rubber plantations. Since this opinion is at variance with experience in most other countries, a pot experiment was carried out in which the two fertilisers were compared under carefully controlled conditions, using Tjir 1 seedlings. In the experiment three different methods of applying the fertilisers (pocketing, mixing and broadcasting) were also compared because there had been some differences in response to varying methods of application in field trials. Finally, since rock phosphate contains considerably more calcium than superphosphate for each unit of $P_2O_5$, the effect of liming on the response of the seedlings to the fertilisers was tested.

Taking the average of all the results, superphosphate proved to be superior to rock phosphate. However, the response to rock phosphate was considerably reduced by liming, while the superphosphate response was not much affected by lime. The use of lime in rubber plantations is not recommended and taking into account only the results obtained in the absence of lime, the difference between the two fertilisers was not found to be very great.

For superphosphate the pocketing method of application proved to be the best, with mixing slightly better than broadcasting. On the other hand, the broadcasting method was found to be best for rock phosphate and pocketing the worst. When the two methods of application normally used in plantations were considered, namely mixing with the soil, as in planting-hole application, and broadcasting on the

surface (in both cases without lime), the two fertilisers were found to give almost similar results.

This experiment thus largely confirms the field experience that rock phosphate and superphosphate are nearly equivalent but there seems to be a definite indication that superphosphate is most effective when applied in pockets, while rock phosphate is best when broadcast on the surface of the soil.

## The Natural Rubber Research Conference

More than 200 scientists from research institutes, commercial concerns and universities in the main rubber producing and consuming countries will gather in Kuala Lumpur at the end of this month to attend the Natural Rubber Research Conference.

This conference should reveal the extent of the effort that is being put into natural rubber research with the object of reducing the cost, improving the quality and extending the use of natural rubber.

The general sessions of the conference were described in an article in our last issue. As we go to press we have received almost all of the papers to be submitted for presentation at the concurrent sessions of the conference. So far eighty-one papers have been submitted, thirty-seven for the sessions on rubber production and forty-four for the sessions on the preparation and use of natural rubber. The programme will allow time for only sixty-five of the authors to introduce their papers to the conference, but there are likely to be many references to the remainder during the discussions of the selected papers.

The following organisations are presenting papers: the Rubber Research Institutes in Cambodia, Ceylon, India, Indonesia, Malaya and Vietnam; the Department of Agriculture in North Borneo; the British Rubber Producers' Research Association; the Institut Francais du Caoutchouc; the Indonesian Research Institute for Estate Crops; the Foundation of Natural Rubber Research and Development in Japan; the Dunlop Rubber Company's Research Centres in Birmingham and Negri Sembilan; Fisons Pest Control research unit in Cambridge; the Goodyear Rubber Plantations Company in Akron, Ohio; Guthrie Latex Ltd; the Chemara Research Stations at Seremban and Layang Layang; Pirelli's rubber plantation at Belém in Brazil; the Produce Research Department of Socfin Ltd, Malaya; the United States Rubber Company; the National College of Rubber Technology, London; the Research Institute of the Sumatra Planters Association; the Botany Department of the University of Florida; and the United States Operations Mission in Vietnam.

The papers together with the text of the addresses delivered at the general sessions of the conference will be printed in the *Proceedings of the Natural Rubber Research Conference*. The *Proceedings* will be published by this Institute at a cost yet to be determined but which will be no more than is required to cover printing and postage.

## Patent: Boric Acid Latex

A patent has been obtained in the United States of America for the preservation of latex concentrate, using boric acid as a

preservative. The boric acid preservation system has been used for some years under licence from the Rubber Research Institute of Malaya and consists of the use of 0.2 to 0.25% wt boric acid together with 0.2% wt of ammonia. The system is described in U.S. Patent No. 2,932,678 granted to K.C. Sekar and J.E. Morris. Patents in Ceylon, Liberia and Australia have already been granted and a British Patent application is pending. Further details of this system may be obtained from the R.R.I.M.

## Exports of Boric Acid Latex

Boric acid latex, judging by the amounts shipped in the first six months of 1960, continues to make an important contribution to the quantities of low ammonia latex produced. The exact proportion of boric acid latex relative to the other low ammonia preservative systems is not known because statistics for the others are not available.

1,559.2 tons (as dry rubber) of boric acid latex were shipped in the first six months of 1960. This shows a decline on the record figures of 1959. The figures in gallons are:

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| 1st half 1959 | 676,238 Imp. gals. |
| 2nd half 1959 | 879,545 „ „ |
| 1st half 1960 | 612,733 „ „ |

Shipments were made both in bulk and in drums by six latex concentrate producers. Ten countries received consignments of boric acid latex. These countries, placed in order of the amounts taken, were Germany, United Kingdom, Belgium, France, New Zealand, Sweden, Norway, South Africa, Japan and Holland; 63.9% went to Europe (excluding Great Britain), 34.0% to Great Britain, 1.6% to Australasia, and 0.5% to Africa.

It is noteworthy that the European market is keenly interested in boric acid latex but certain countries, notably U.S.A., Japan and Australia, which are normally important customers for latex, have shown little interest.

## Australian Import Duty: Exemption of Special Rubbers

A note was published in *Planters' Bulletin 42*, May 1959, page 71, listing certain special rubbers which were exempted from payment of Australian customs duty. Further discussions have since taken place to determine whether other special rubbers may be included. We have been officially informed by the Government that the following products have been classified under the Australian tariff categories of materials on which no duty is paid.

1. In Category 330(A). Partly vulcanised rubber crumb or powder.
2. In Category 330(A). Vulcanised latex.
3. In Category 369(C)(4). Natural rubber copolymer with methyl methacrylate (consisting of approximately 25% natural rubber and 75% methyl methacrylate) when not processed.

If the copolymer (No. 3 above) has been moulded or pressed in Malaya, a duty of 7½% is charged in category 369(D)(4).

Rubber solutions or dispersions are classified as item 255(B)(1) and the rate of duty is 47½%.

To our knowledge, neither of these two dutiable classes of materials are exported from Malaya.

## Termite Control

Our recommendations on termite control, discussed in the general article on termites in *Planters' Bulletin 19* and later in short notes in Numbers *26* and *32*, require to be revised in the light of later work on the effect of soil type on the persistence of toxicity.

A peaty soil, alone of the six soils tested, quickly inactivated all the insecticides. Coastal alluvial clay was the next to lose its toxicity. The highly adsorptive nature of these soils suggests that loss of toxicity is an adsorption effect. The other four soils — a volcanic clay loam, a lateritic sandy loam, a coarse sandy loam and a fine sandy loam — retained the toxicity of aldrin for over two years and the toxicity of dieldrin for over four years, when treated at the rate of 500 ml of a 0.05% emulsion per 6 lb of air-dried soil. Chlordane at an equivalent dosage persisted for only three to five months in these soils.

To be about equally persistent, the relative dosages of chlordane, aldrin and dieldrin need to be approximately 3:2:1. The chlordane formulation currently available in this country is uneconomical compared with aldrin and dieldrin formulations. We recommend that Aldrex 2 be diluted with 400 parts of water (making a 0.05% emulsion) and Dieldrex 15 with 600 parts of water (making a 0.025% emulsion). The quantity to be applied to each tree ranges upwards from one pint, depending on its size.

Although dieldrin is generally the most persistent of the three insecticides named, aldrin persists longer in peaty soils; but to get persistence in peaty soil the dosage must be considerably increased — we recommend that Aldrex 2 be used at four times the normal dosage.

The cost of these insecticides at the low rates of application needed is so small that it is feasible to treat every tree in a badly infested area, giving effective protection for two years or more, the period depending on the soil type and dosage applied.

## Identification of Clones

We occasionally receive requests for our clone inspectors to identify individual trees, intended as a source of branch budwood for use in field or nursery. We are pleased to meet this requirement as far as more pressing work allows. When our inspectors make such visits, they are also able to assist by indicating the most suitable branches from which budwood can be taken.

A much simpler method of clone identification, however, is by means of its seed. Managers must be certain that the seed sample is obtained from the tree to be identified, either by picking nearly mature pods or by bagging pods. Seed should never be collected from the ground for this purpose.

Seeds from different trees should be numbered, or packed in separate envelopes, and sent to us (P.O. Box 150, Kuala Lumpur) addressed for the attention of the Botanical Division. We shall then compare them against our type specimens, and return the correct identification to the estate within a matter of hours. We hold type specimens of seeds of all clones likely to be employed in replantings in Malaya.

We do not return seed unless a request accompanies the sample. No charge is made for the service which is a cheap, rapid and efficient method of identifying individual trees.

## Book Review

**Elsevier's Rubber Dictionary.** (English, French, Spanish, Italian, Portuguese, German, Dutch, Swedish, Indonesian and Japanese) 1959, pp. 1537, Amsterdam; Elsevier Publishing Company, $135.00 (Malayan). Distributed by van Nostrand, New York and London.

This very comprehensive dictionary in ten languages has been compiled by the Rubber Foundation in Holland, assisted by the appropriate research organisations in the countries whose languages are represented. The dictionary covers the terms used in rubber cultivation as well as those used in processing and manufacturing. Apart from a few errors, it is accurate and admirably arranged. It will be useful to all in the rubber planting and manufacturing industry who are faced with problems of translation.

## R. R. I. News

Dr P. R. Wycherley has recently made a duty tour of Trinidad, Panama, Costa Rica, Guatemala, Brazil and Ceylon. His first object was to study progress in botanical aspects of *Hevea* research, especially breeding programmes directed towards resistance to *Dothidella* and other fungi. He visited Dr M.H. Langford (Plant Pathologist and Coordinator of Rubber Programme) in Panama and Mr C. Townsend (Horticultural Adviser) in Guatemala, both of whom have been associated with this work in the United States International Cooperation Administration for many years. The research and experiment stations of the following institutes were visited: Instituto Agronômico do Norte, Belém and Estabelecimento Rural do Tapajós, Belterra, both in Pará, Brazil; Rubber Research Institute of Ceylon; Instituto Interamericano de Ciencias Agricolas, Turrialba, Costa Rica; Instituto Agropecuario Nacional, Los Brilliantes, Guatemala; and the Imperial College of Tropical Agriculture, Trinidad, B.W.I. Some commercial ventures were seen in each country.

A further object of Dr Wycherley's discussions was the establishment of a research unit at the Imperial College in Trinidad for fundamental research on the fungus *Dothidella* and on the resistance of *Hevea* to South American Leaf Blight which is caused by this fungus.

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Dr C. F. Arlett has accepted an appointment with the Rubber Research Institute of Malaya as a Botanist on contract for three years. He will open a unit of the Institute at the Imperial College of Tropical Agriculture in Trinidad to work on the fungus *Dothidella ulei,* which is responsible for South American Leaf Blight. Dr Arlett graduated in 1956 with first class Honours in Agricultural Botany at the University College of Wales, Aberystwyth. He was awarded an Agricultural Research Council Studentship and went to the University of Birmingham in 1956, where he obtained an M.Sc. Dr Arlett's special interest is in the microgenetics of fungi, on which he has submitted two theses qualifying for his Ph.D and also an article in *Nature.*

## R.R.I. Lectures to Planters

This is a revised list of lectures available to Planters' Societies. When requesting a lecture, please name alternative titles and give the Director adequate notice of your requirement.

*Soils Division*

Observations on manuring of rubber based on results of field experiments
Current thoughts on ground covers in rubber areas
Recognition of nutrient deficiency symptoms shown by rubber and legume covers (evening lecture)
The absorption and translocation of nutrients by plants (evening lecture)

*Botanical Division*

Work of the Botanical Division
Breeding and selection of RRIM clones
Planting material in practice
Tapping and stimulation of yield
Factors affecting the performance of *Hevea*
Further work on yield stimulation

*Pathological Division*

Root disease control and the role of fungicides
Diseases and injuries of the stem and branches (evening lecture)
Recognition of pests (evening lecture)

*Chemical Division*

Superior processing rubber
Latex concentrate production
General processing of plantation rubber
Synthetic rubber
Technical liaison between producer and consumer

*Statistics*

Planning field experiments

*Advisory*

The Estates Advisory Service and its work on field problems

OUR COVER PHOTOGRAPH SHOWS A LABORATORY ASSISTANT MEASURING SOIL REACTION BY MEANS OF AN ELECTRICAL pH METER.

The Standard Engravers & Art Printers, 63 Campbell Road, Kuala Lumpur, Selangor